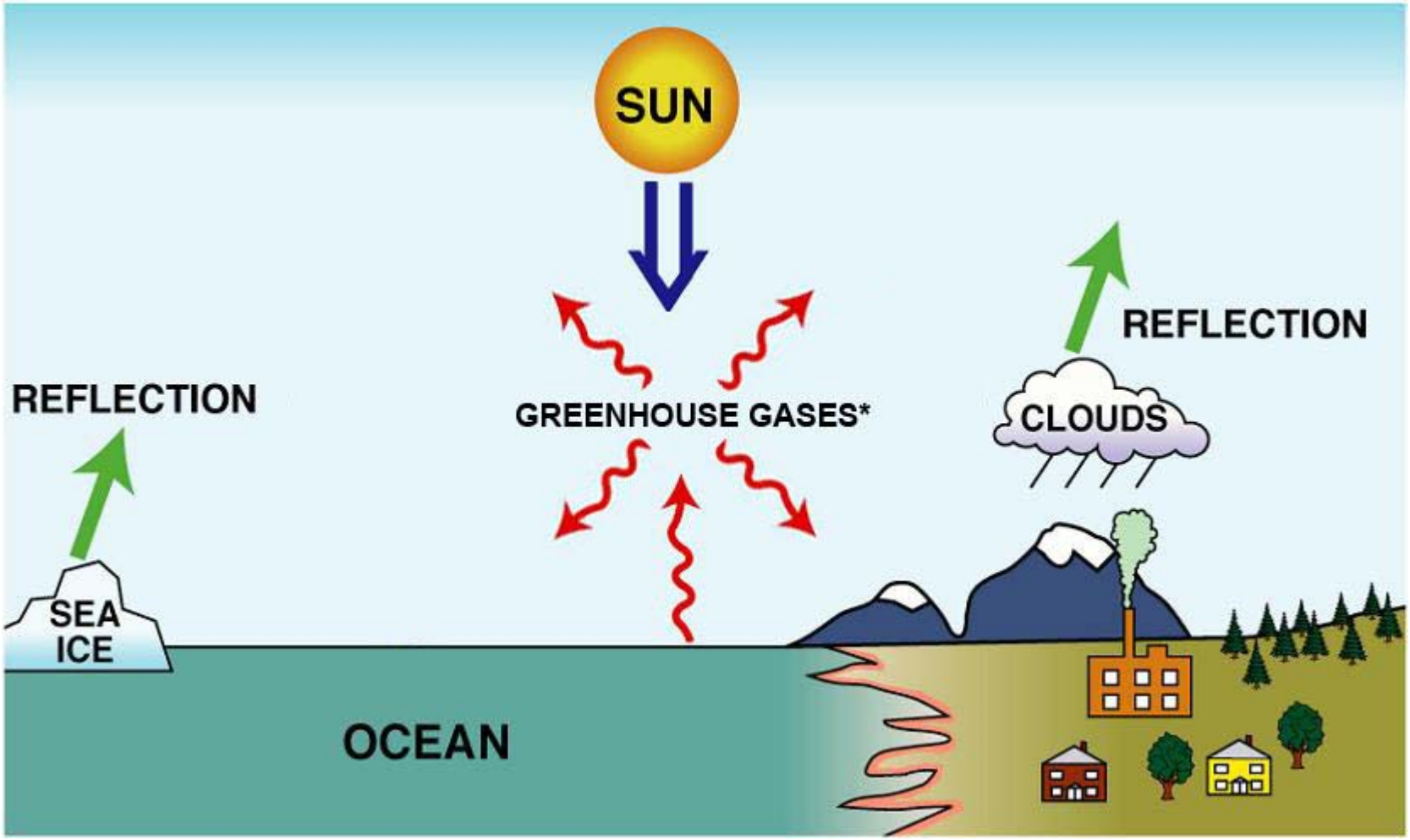
Climate change and Its Impacts on the Pacific Northwest

University of Washington
Program on Climate Change

Part I

Global Climate Change

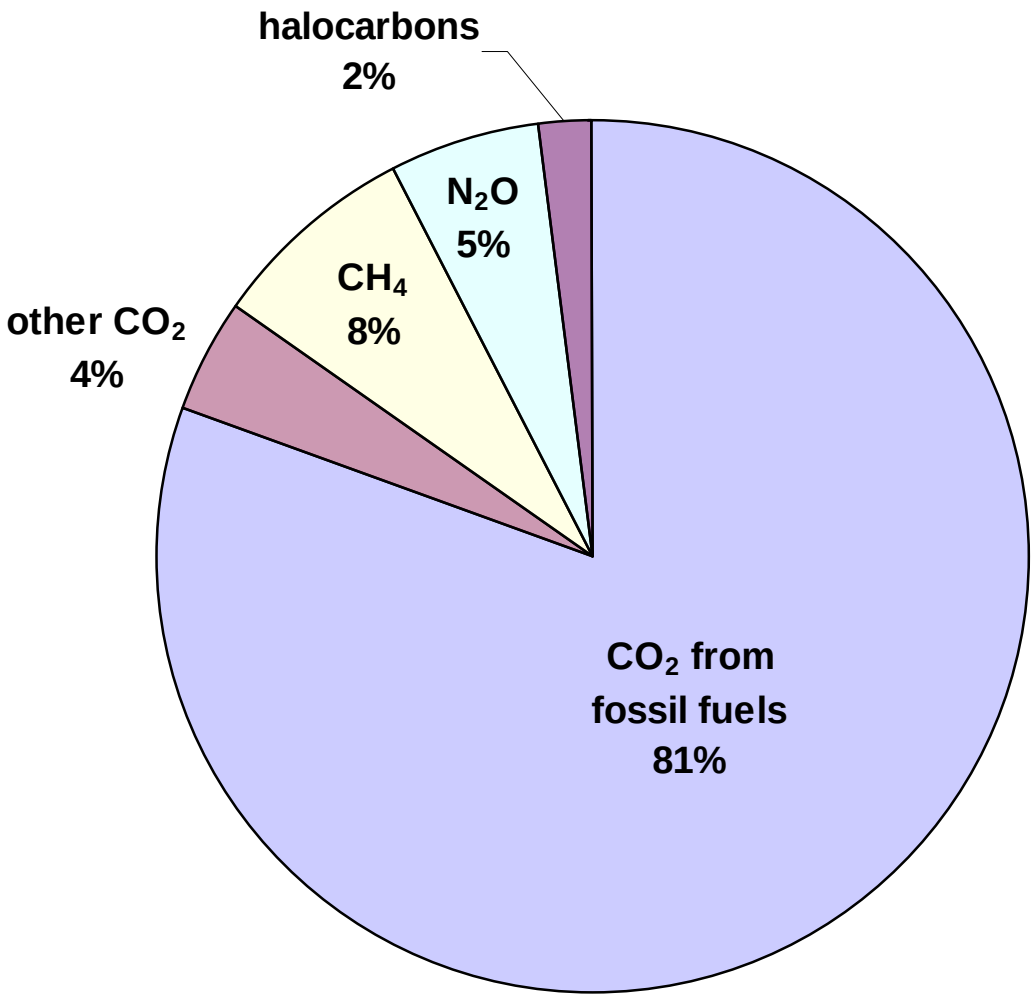
Greenhouse gases and Earth's energy balance



* H_2O, CO_2, CH_4, N_2O, halocarbons

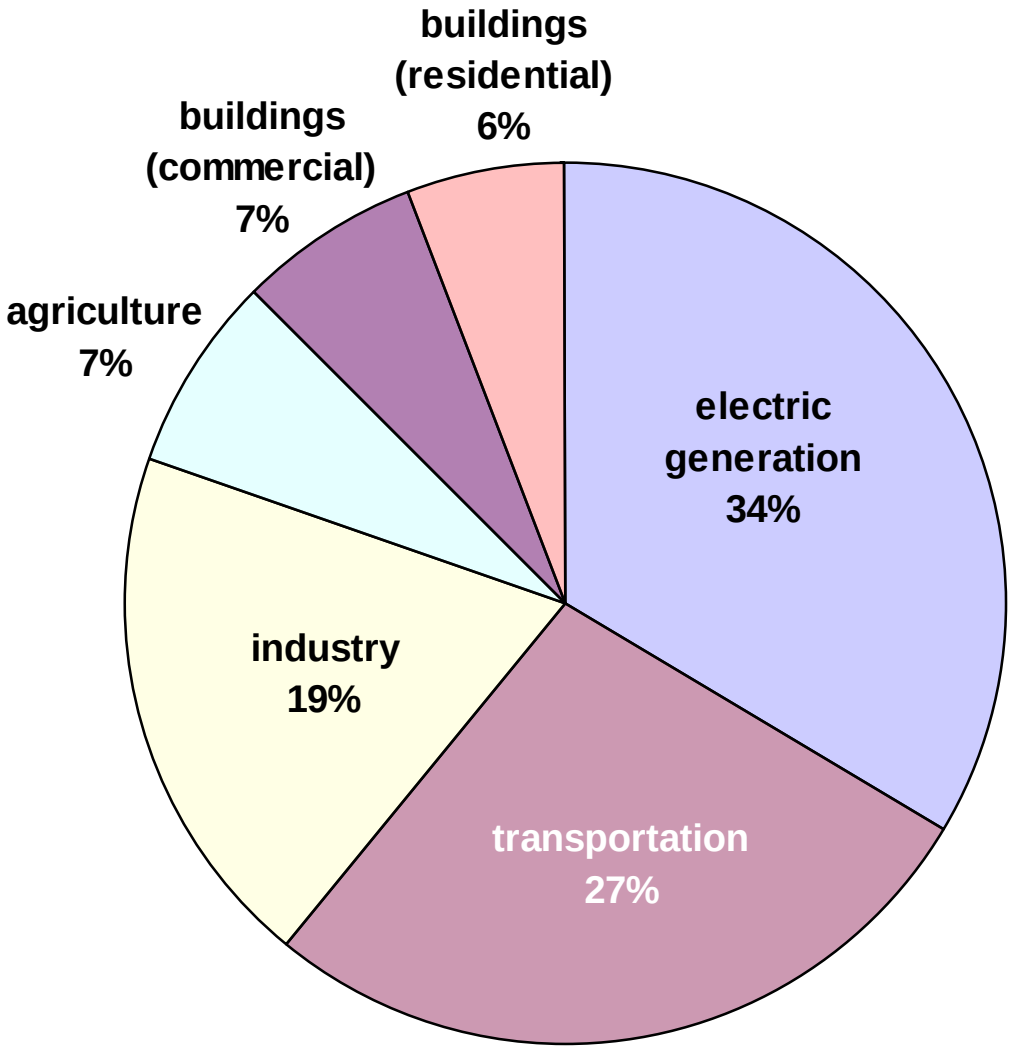
Source: Broecker 2002

Anthropogenic GHGs



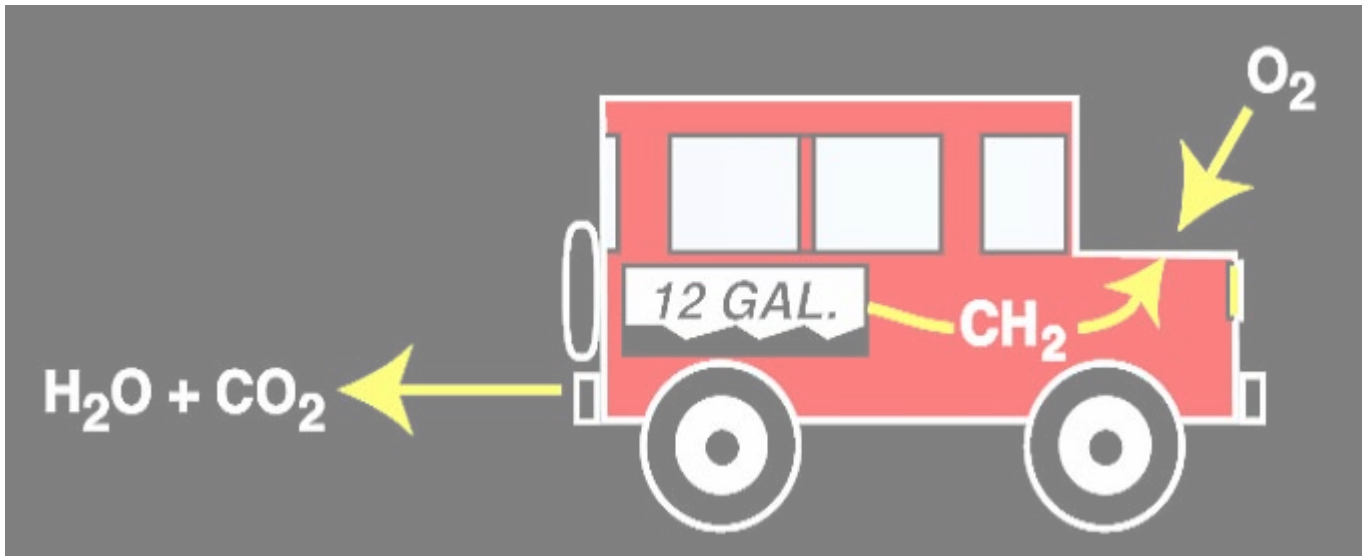
Source: U.S. EPA 2005

Sources of anthropogenic GHGs



Source: U.S. EPA 2005

How cars generate CO_2



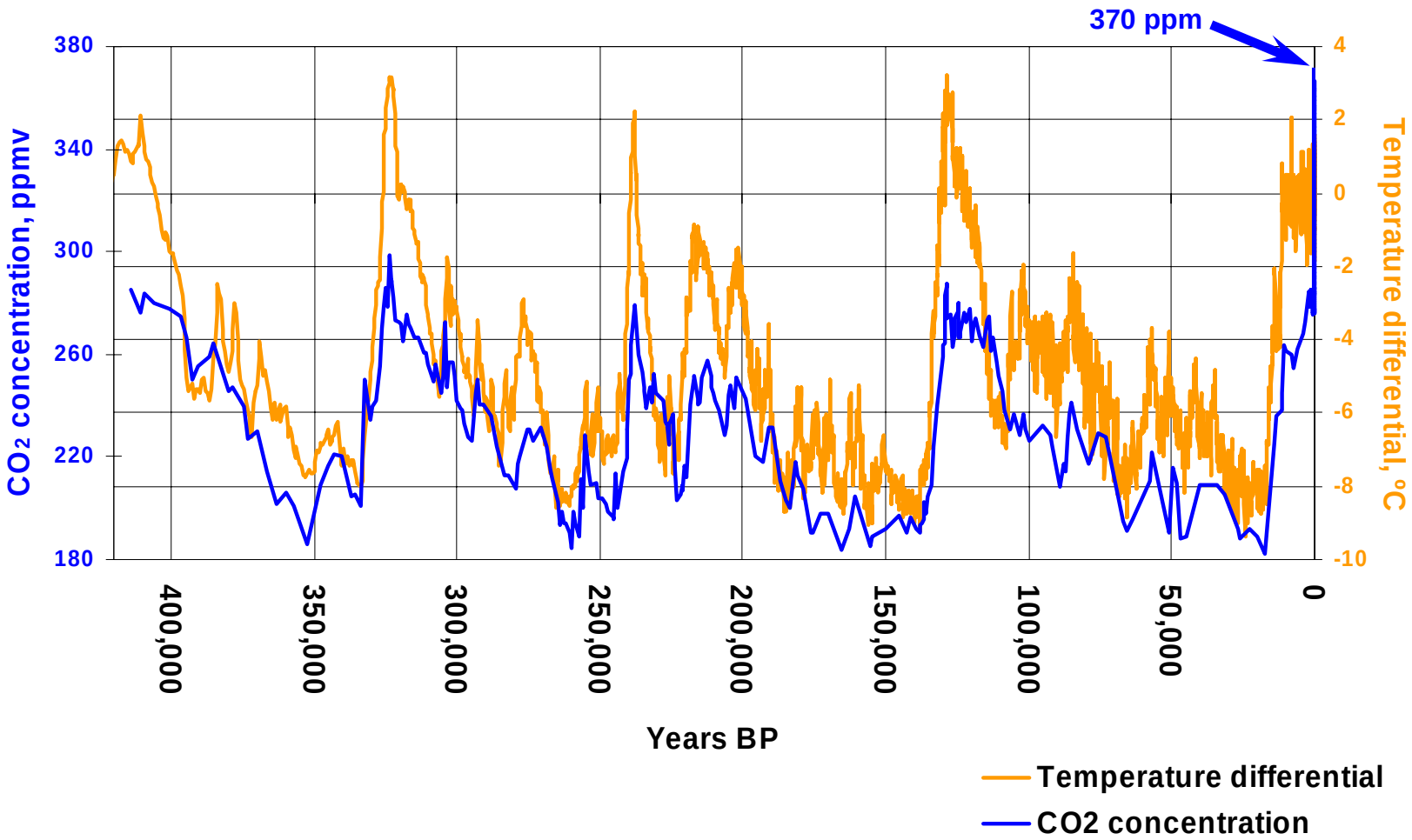
$$CH_2 + 1.5O_2 \rightarrow CO_2 + H_2O$$

6.3 lb/gal

20 lb/gal

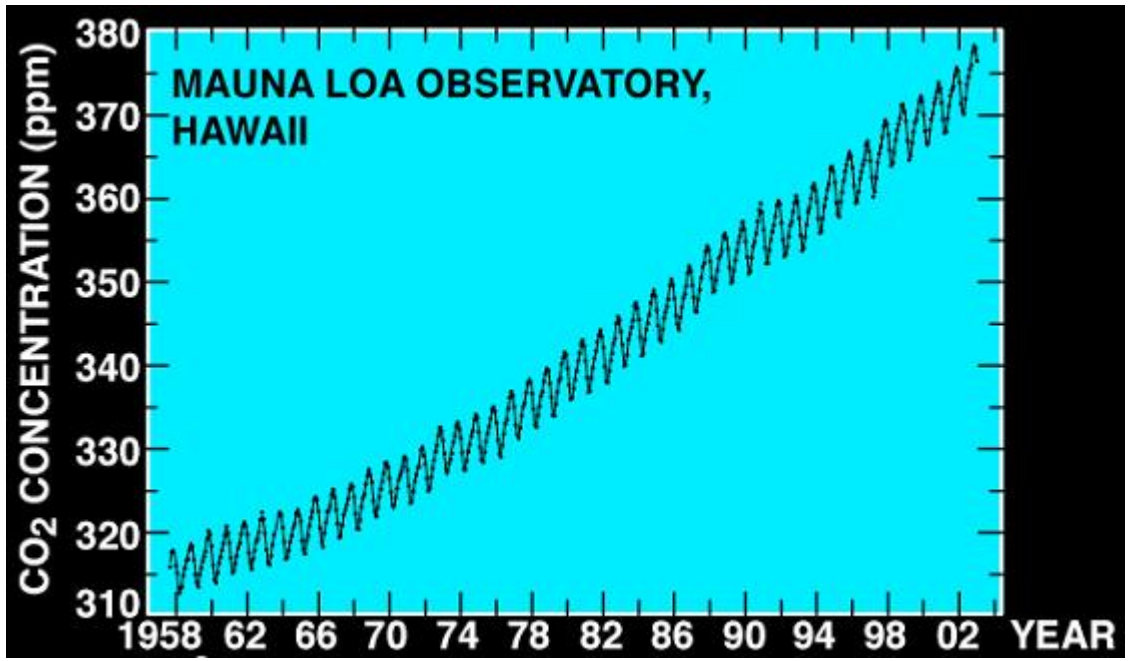
Source: Murray 2005

CO_2 and temperature, 420,000 BP to present



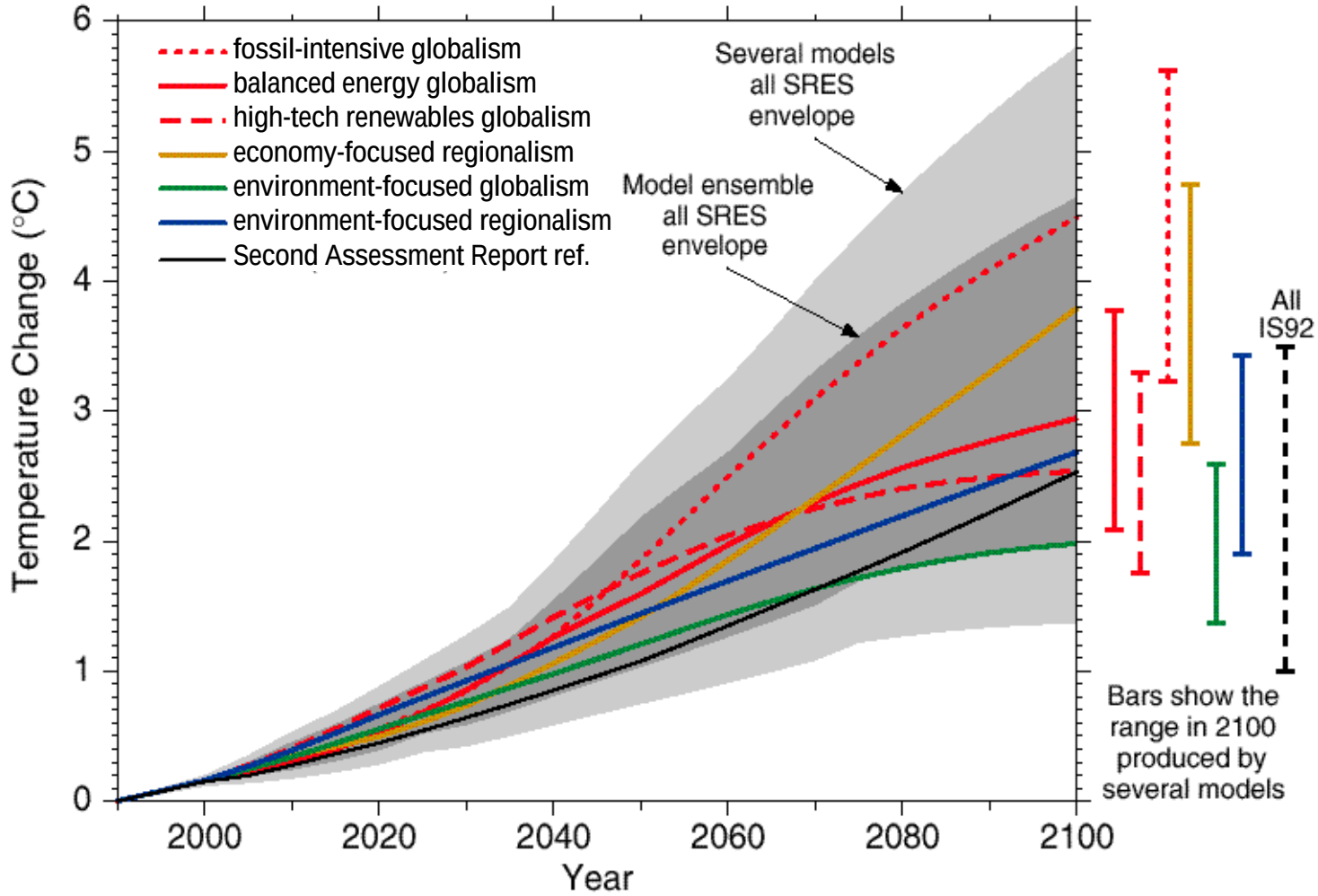
Source: Davies 2000

CO_2 1958 to present



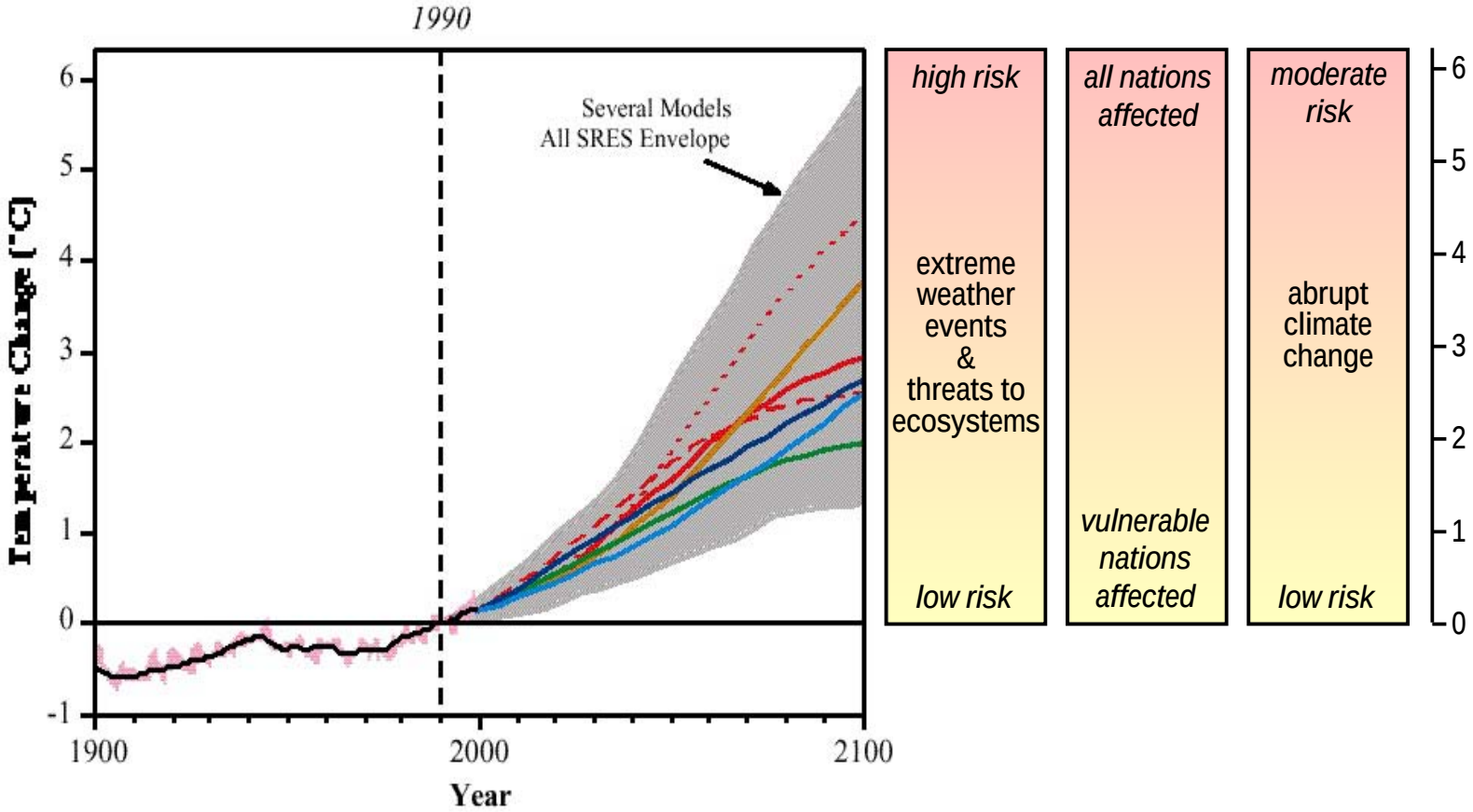
Source: Murray 2005

Future climate change



Source: IPCC 2001

Risks of future climate change

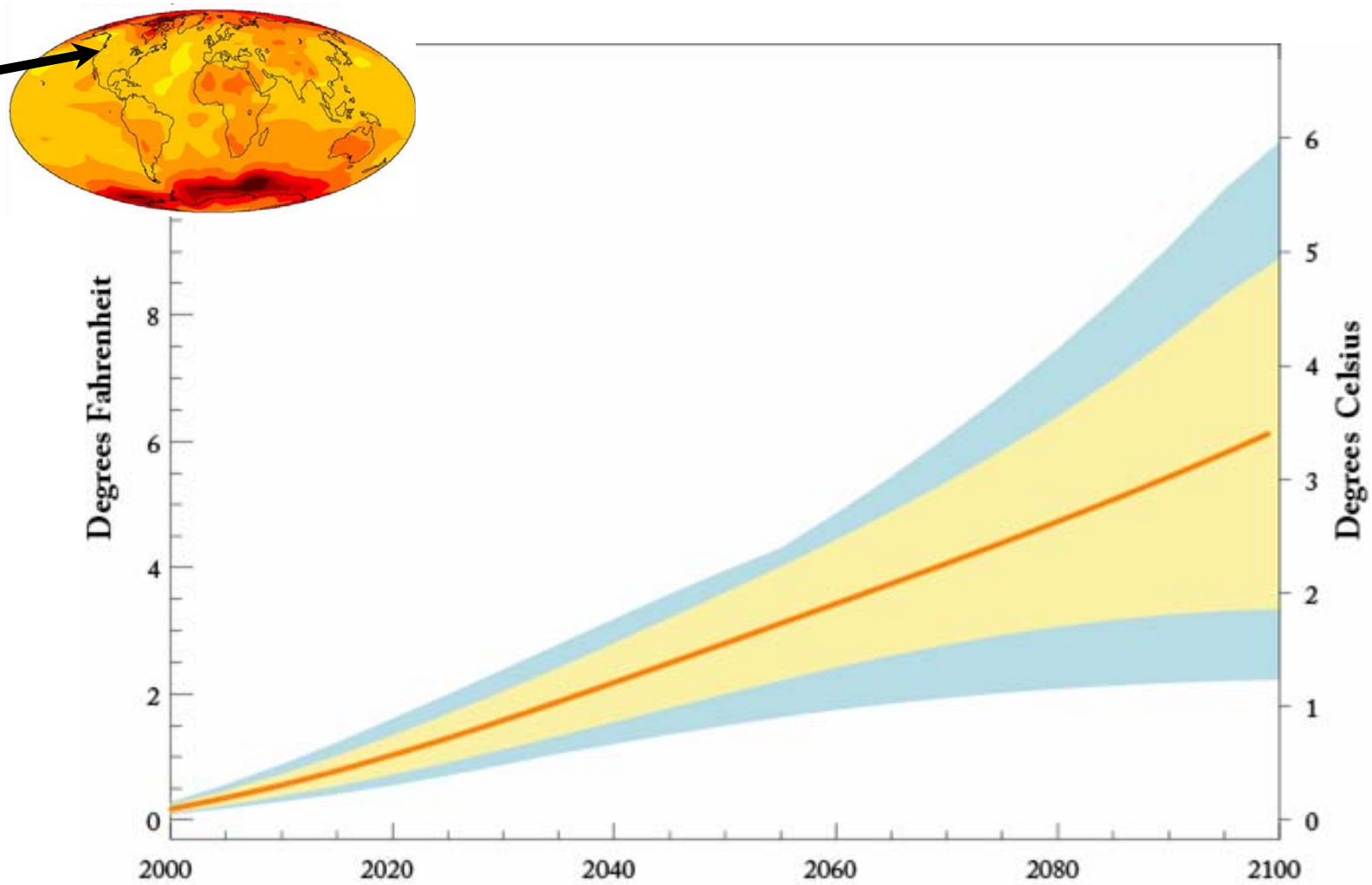


Source: IPCC 2001a

Part II

Pacific Northwest Impacts

Projected Northwest warming, 2000-2100

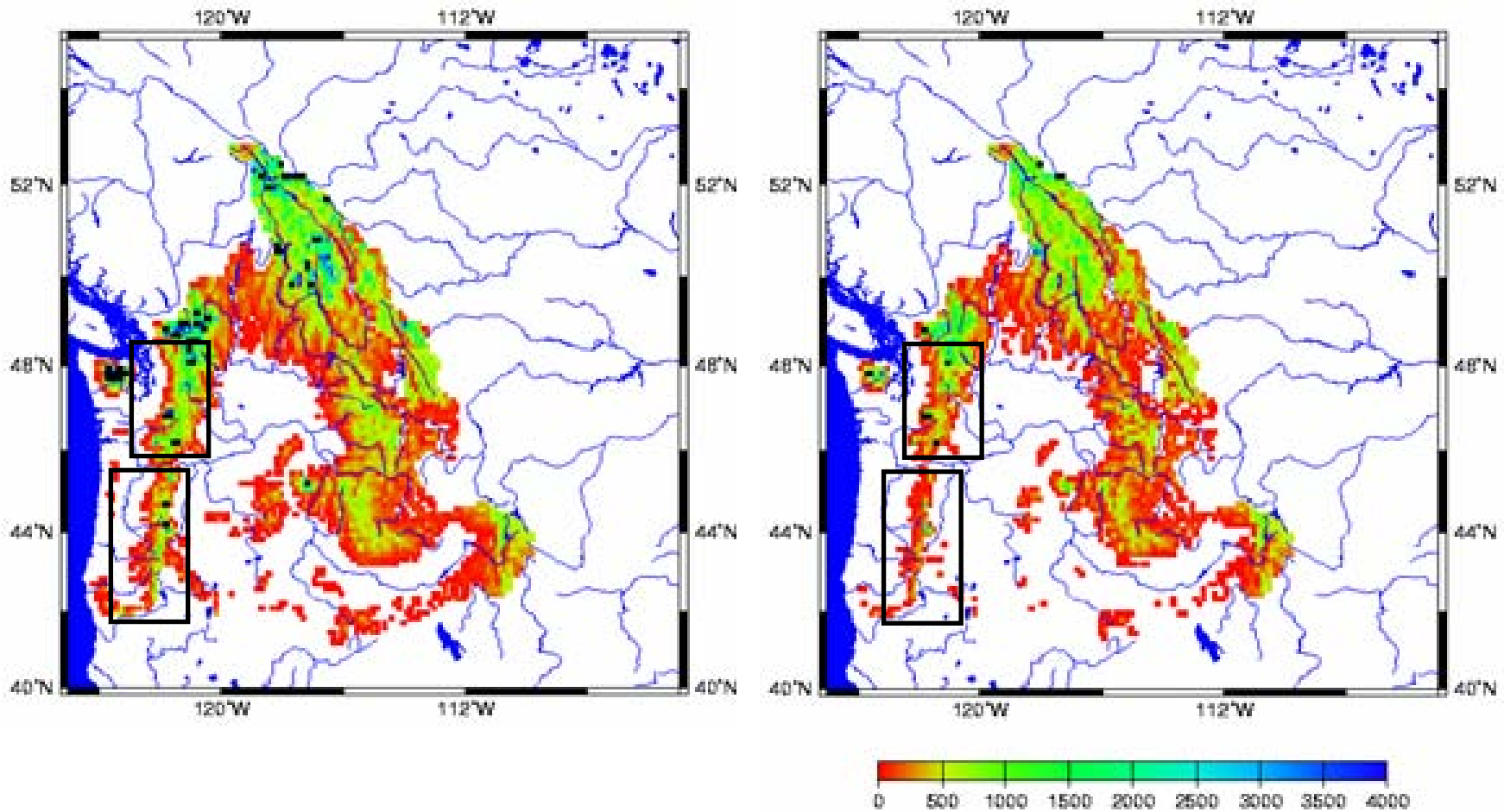


Source: Mote, Salathé and Peacock 2005

Projected snowfall change

current climate

+4.5°F (2060's)

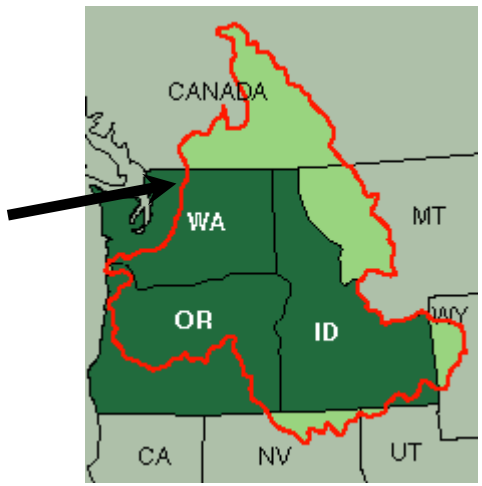


Source: Whitely-Binder 2006

Retreat of the South Cascade glacier

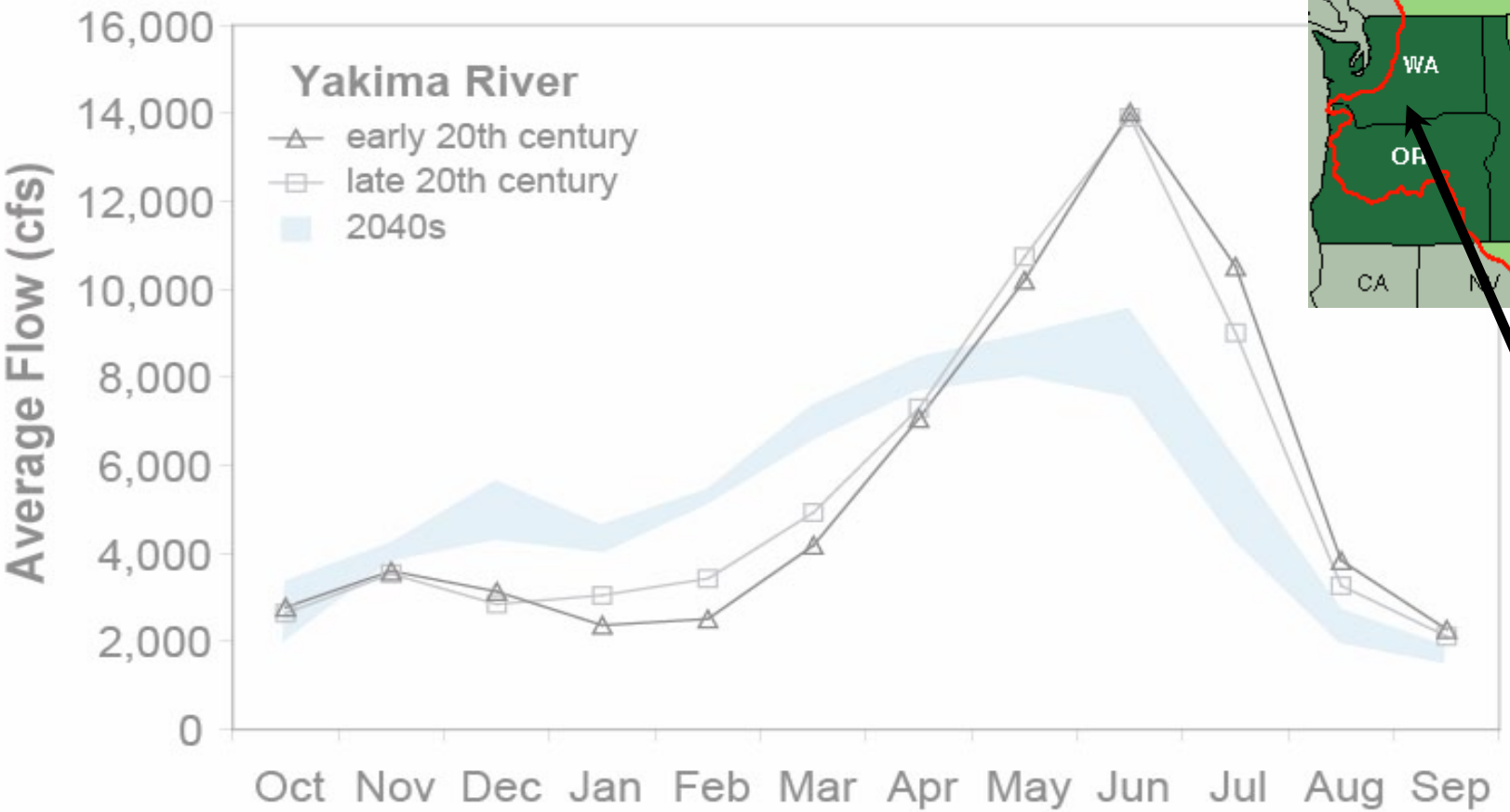
1928

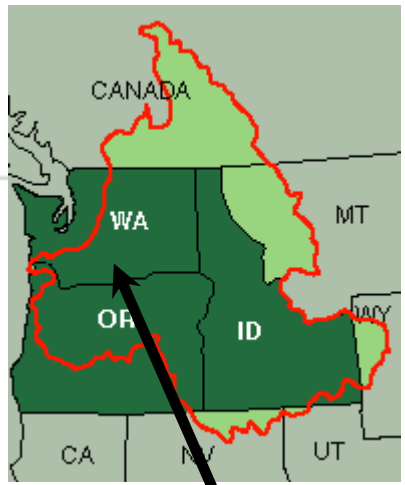
2000



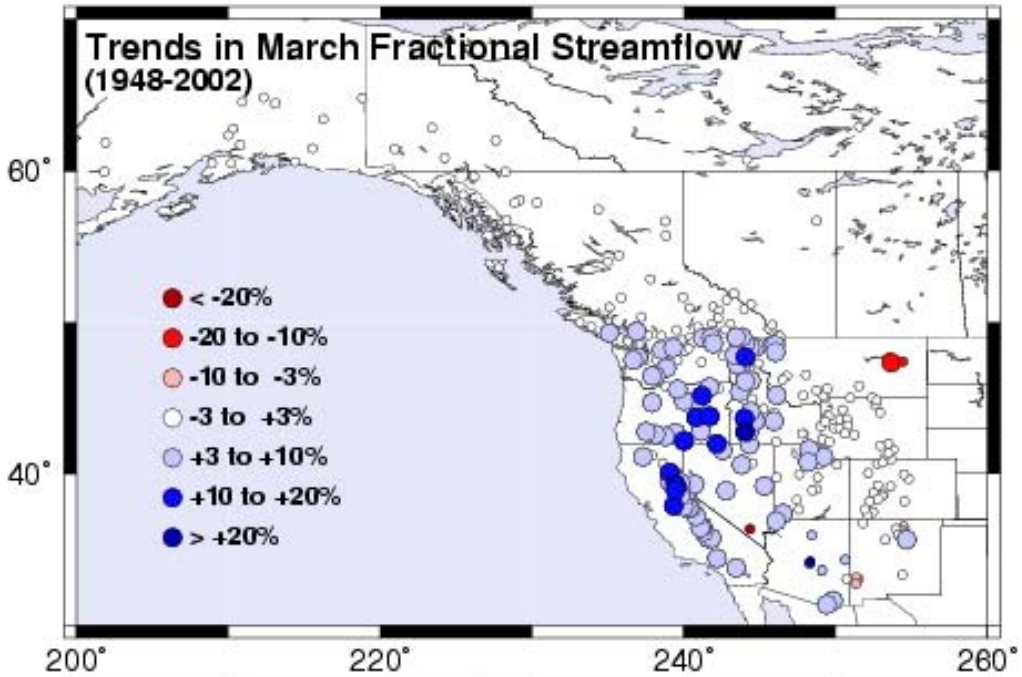
Source: USGS 2005

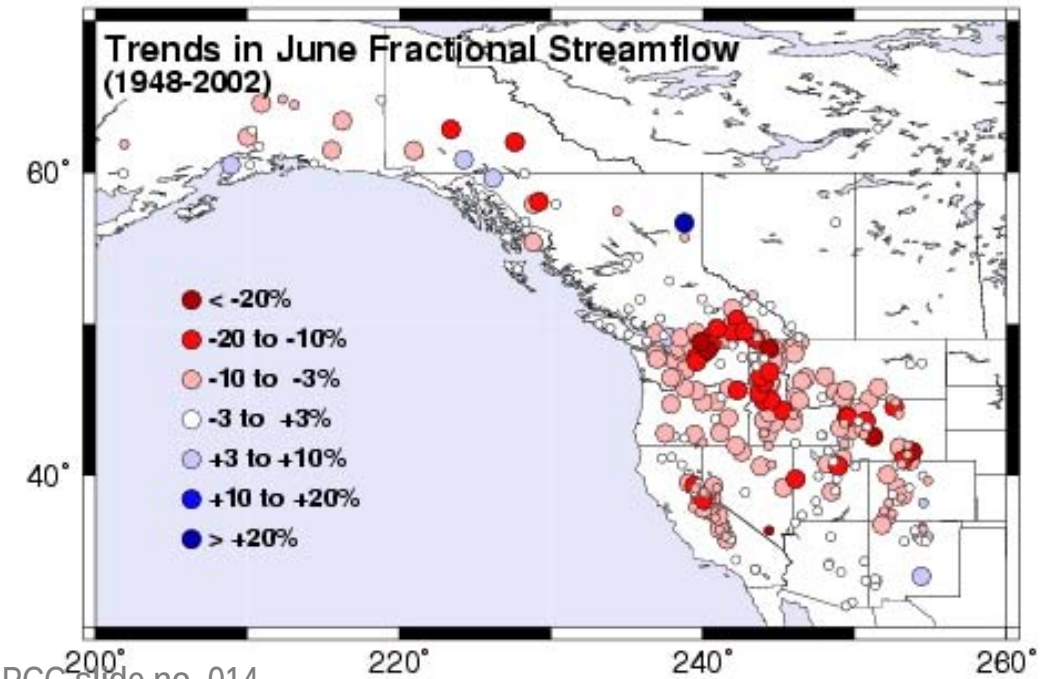
Effect on modeled Yakima River streamflow





Source: Whitely-Binder 2006





Trends in actual streamflows, 1948-2002

March

June

Source: Stewart, Cayan & Dettinger 2005

Combined effects of reduced snowpack

water supply

hydroelectric power

flood control

river ecosystems (salmon)

irrigation

winter recreation

Source: Whitely-Binder 2006

Other effects

forest ecosystems

weather changes

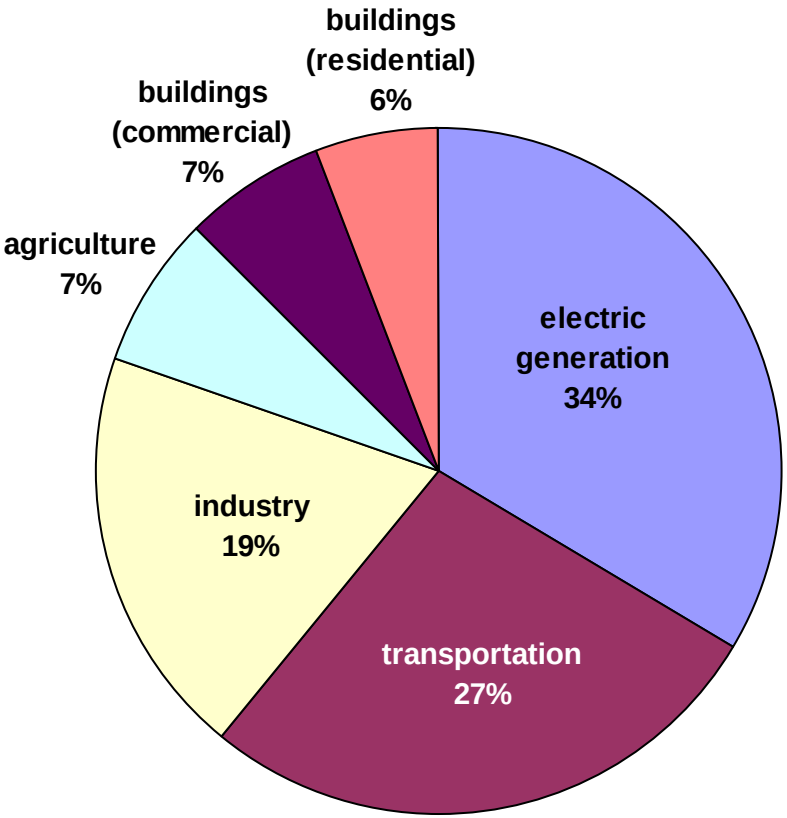
coastal erosion

Part III

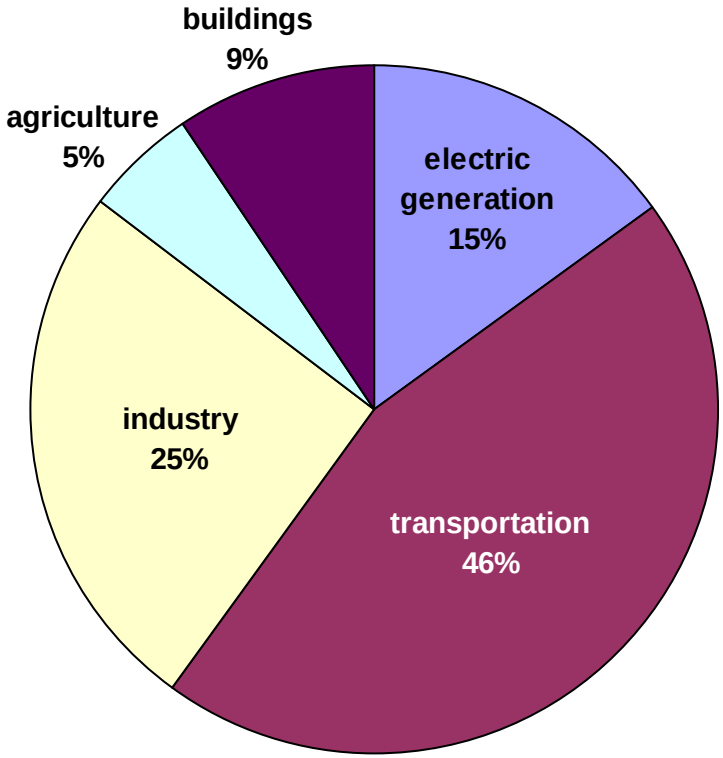
Focus on Transportation:

Reducing Emissions, Adapting to Impacts

Why a Washingtonian needs to think differently



U.S. GHGs



Washington GHGs

Source: U.S. EPA 2005; Washington State 2004

Reducing transportation emissions

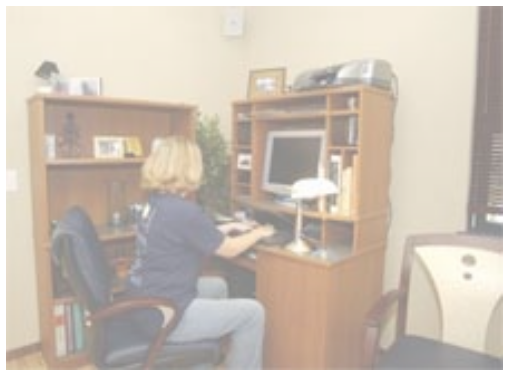
drive an alt-fuel car

drive a fuel-efficient car

use HOVs

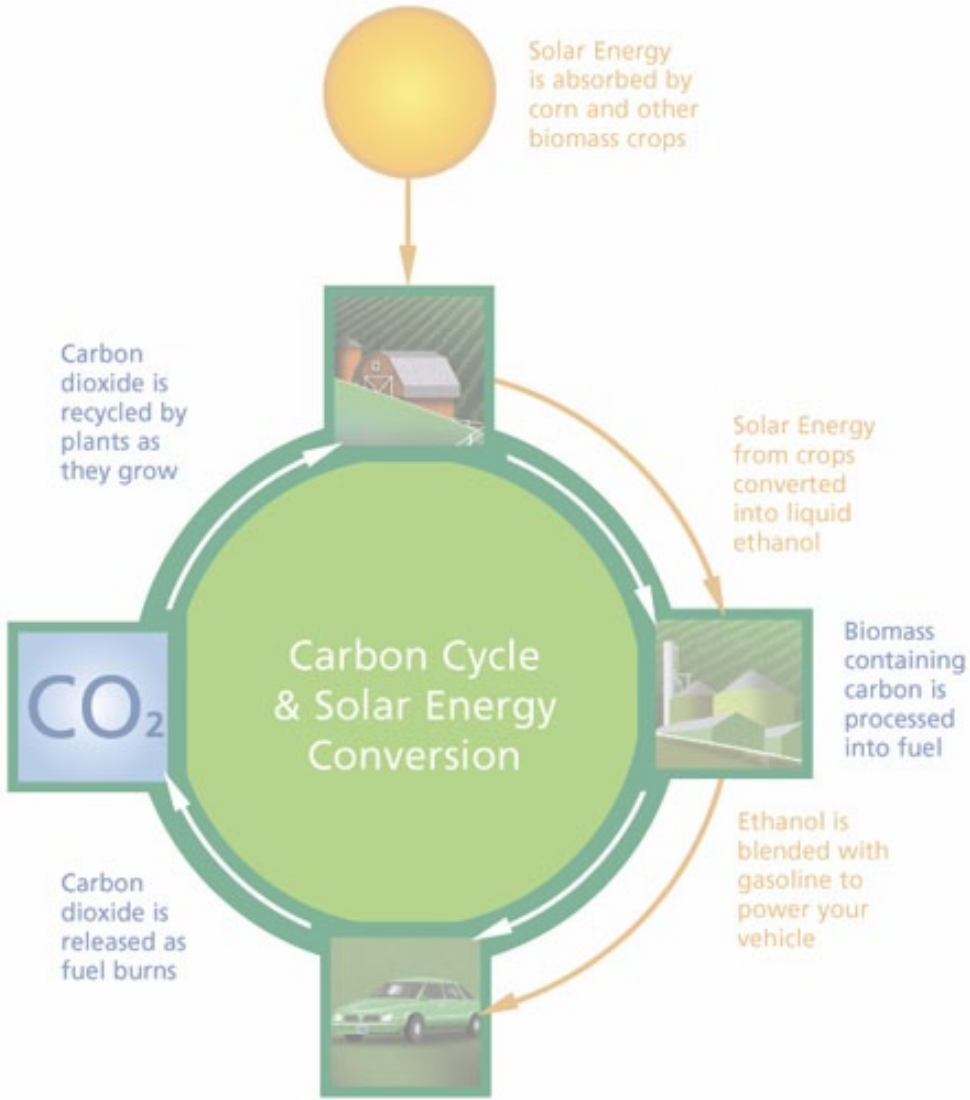
walk or bike

combine errands



telecommute

Why biofuels are climate-neutral

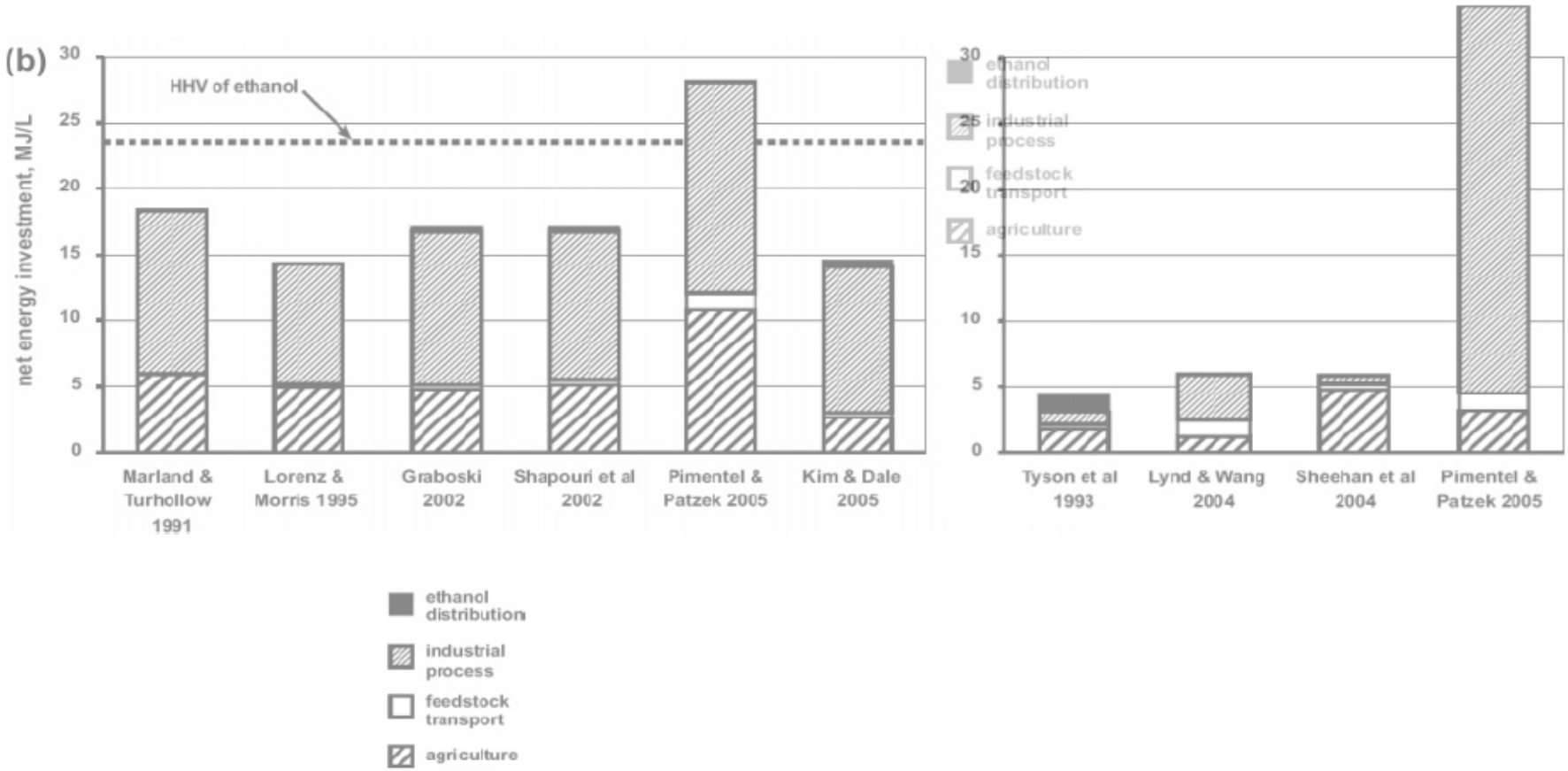


Source: Renewable Fuels Association 2006

Ethanol's fossil energy requirements

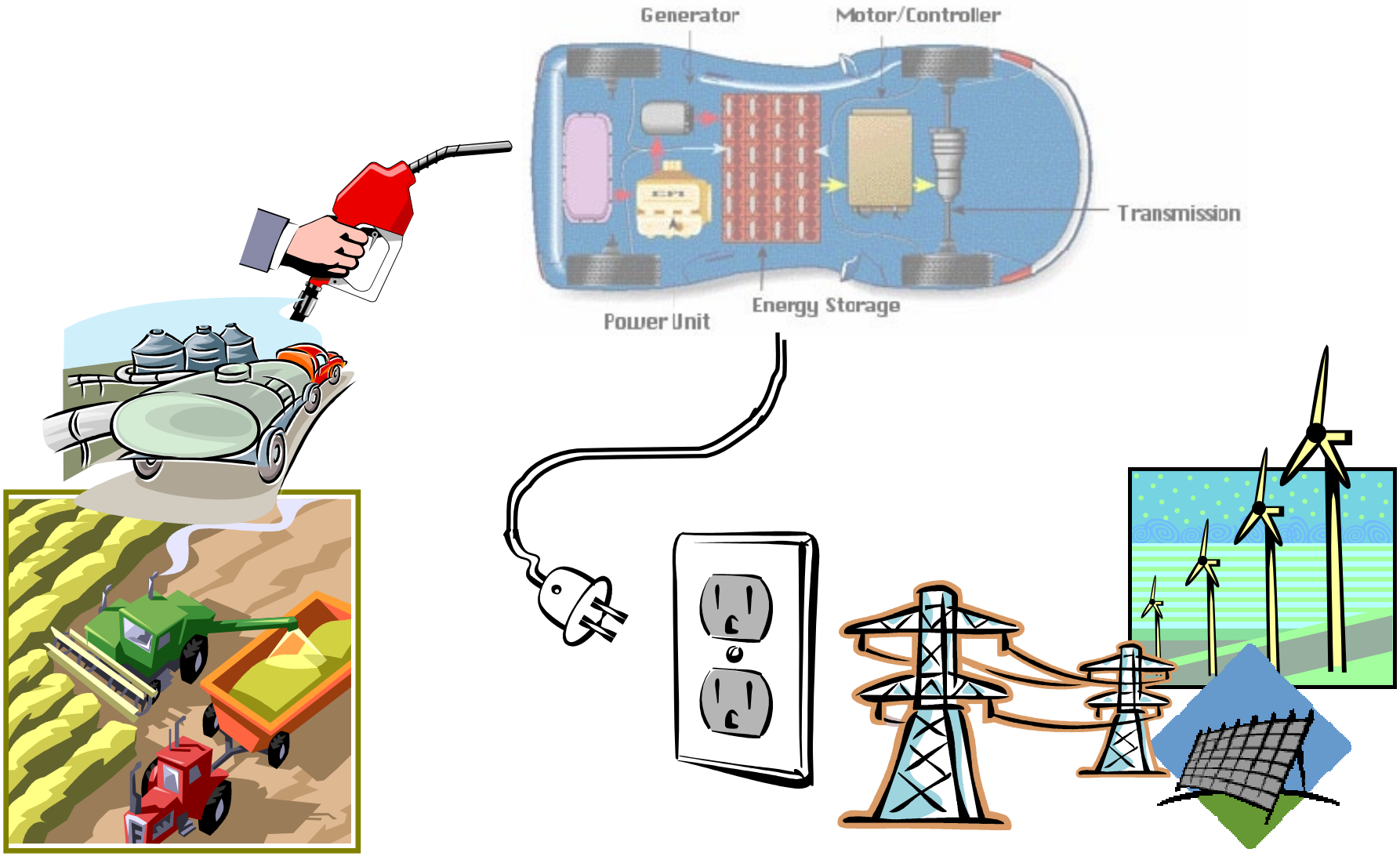
corn ethanol:

cellulosic ethanol:



Source: Hammerschlag 2006

PHEV – the perfect compromise?



Source: PCC 2006

Seattle City Auditor's report

Flooding and Landslides Could Increase

Seawall Heights May Need Adjustments

Roadways May Deteriorate More Rapidly

Bridges Vulnerable to Temperature, Precipitation, and Sea Level Changes

Urban Forestry Already Impacted by Climate Change

Source: City of Seattle 2005

For more information...

IPCC Summaries for Policymakers: www.ipcc.ch

UW Climate Impacts Group: www.cses.washington.edu/cig

UW Climate Impacts Group comprehensive whitepaper: www.cses.washington.edu/db/pdf/kc05whitepaper459.pdf

Climate Solutions: www.climatesolutions.org

The End.

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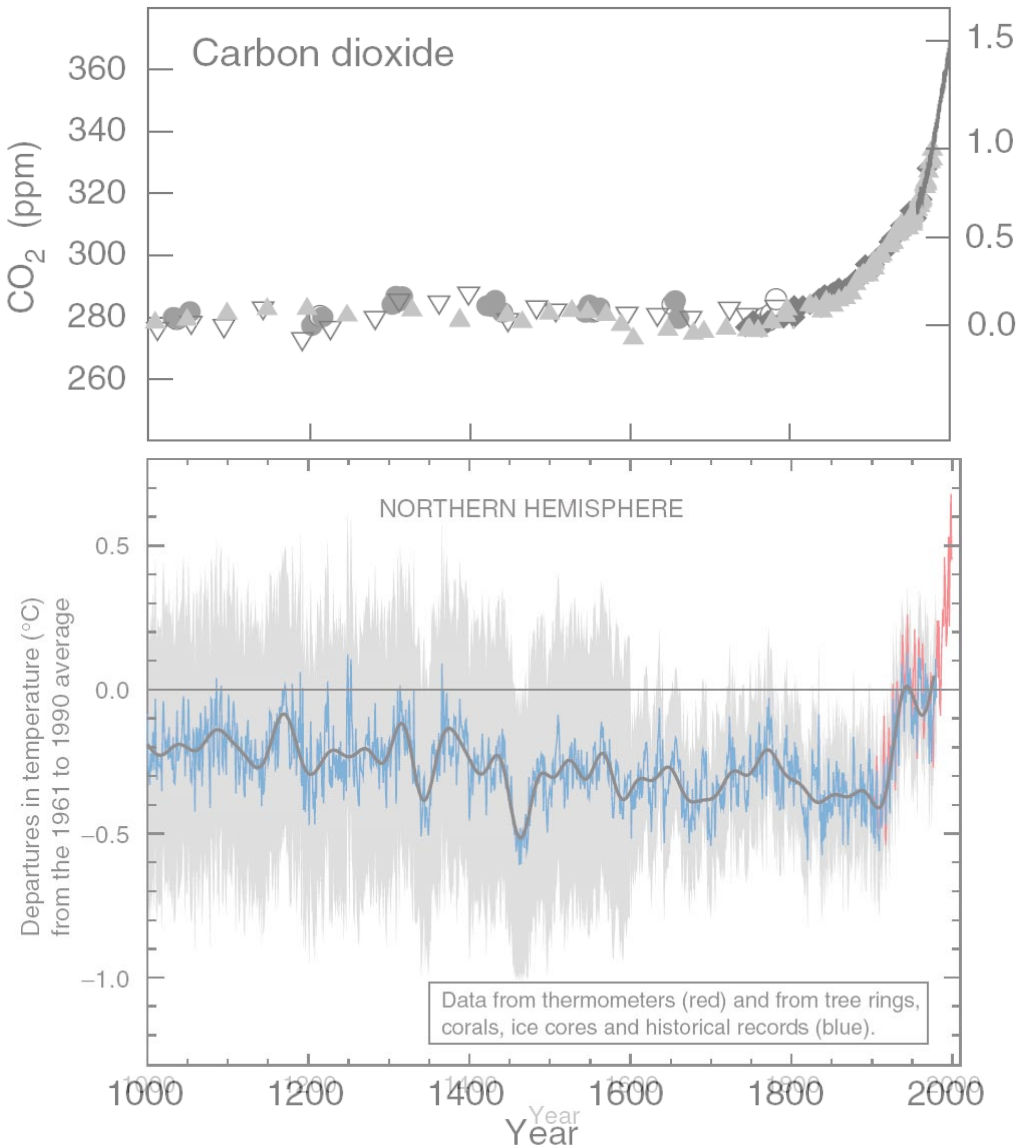
annexes

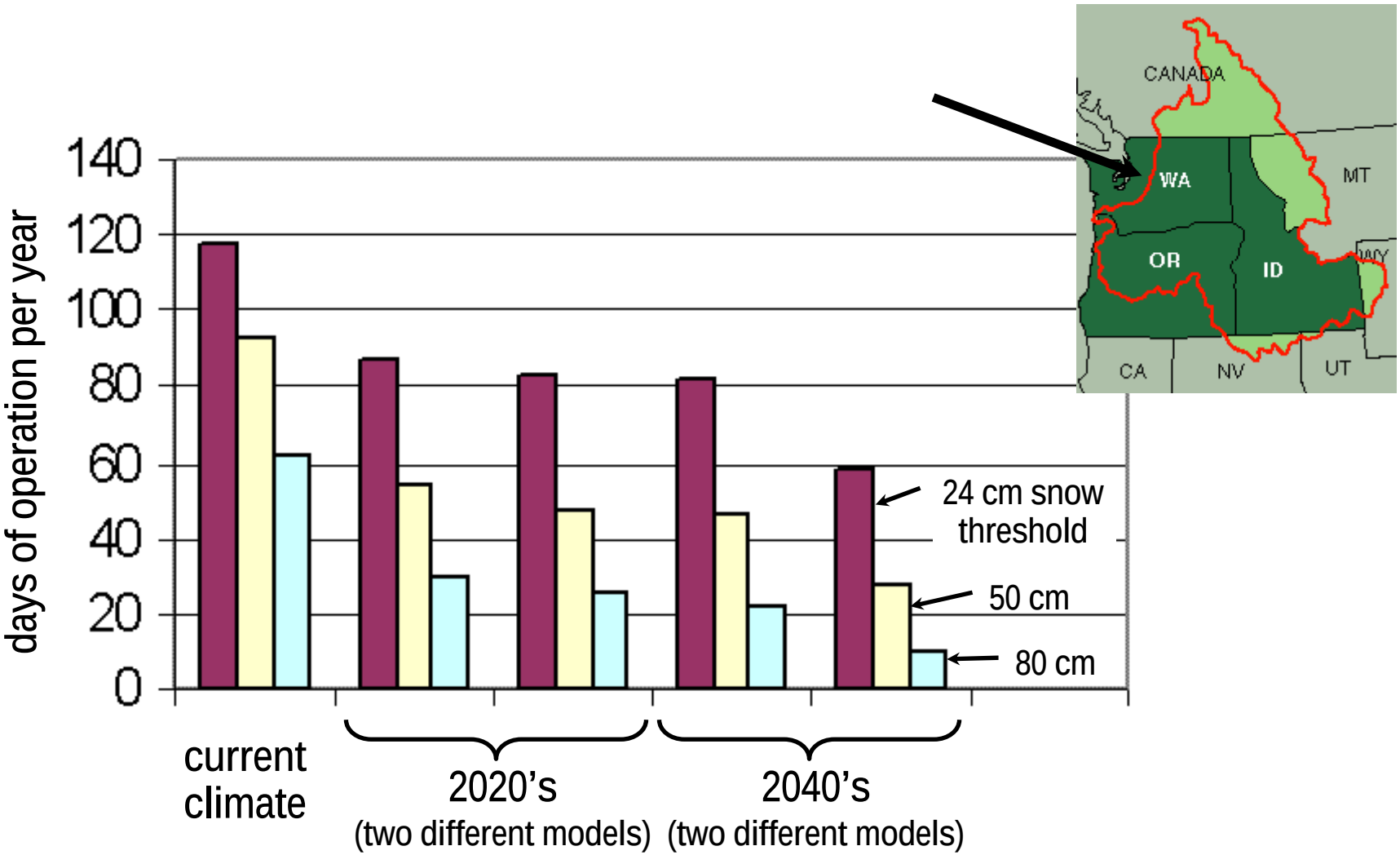
1. CO_2 and temperature 1000 AD to present
2. Effect on Snoqualmie Pass ski industry
3. Effects on salmonid lifecycle
4. Vegetation carbon in 2070-2100
5. Sea level rise
6. Gasoline, hybrid & electric car CO_2 emissions
7. Hybrid-electric vehicles
8. Hydrogen vs. electricity
9. Competing uses of renewable energy

CO_2 and temperature, 1000 AD to present



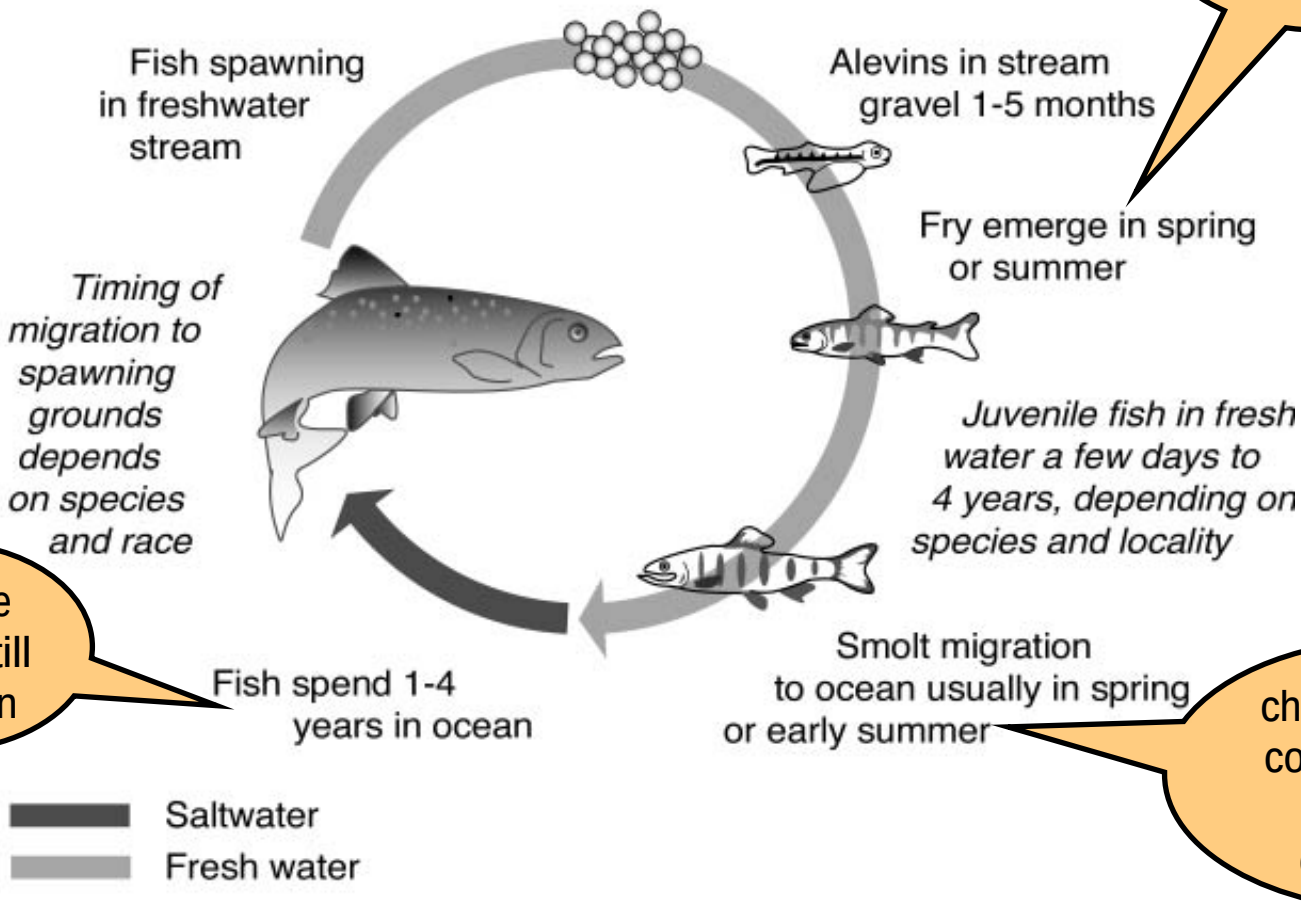
Source: IPCC 2001

Effect on Snoqualmie Pass ski industry



Source: Mote 2005

Effects on salmonid life-cycle



winter flooding

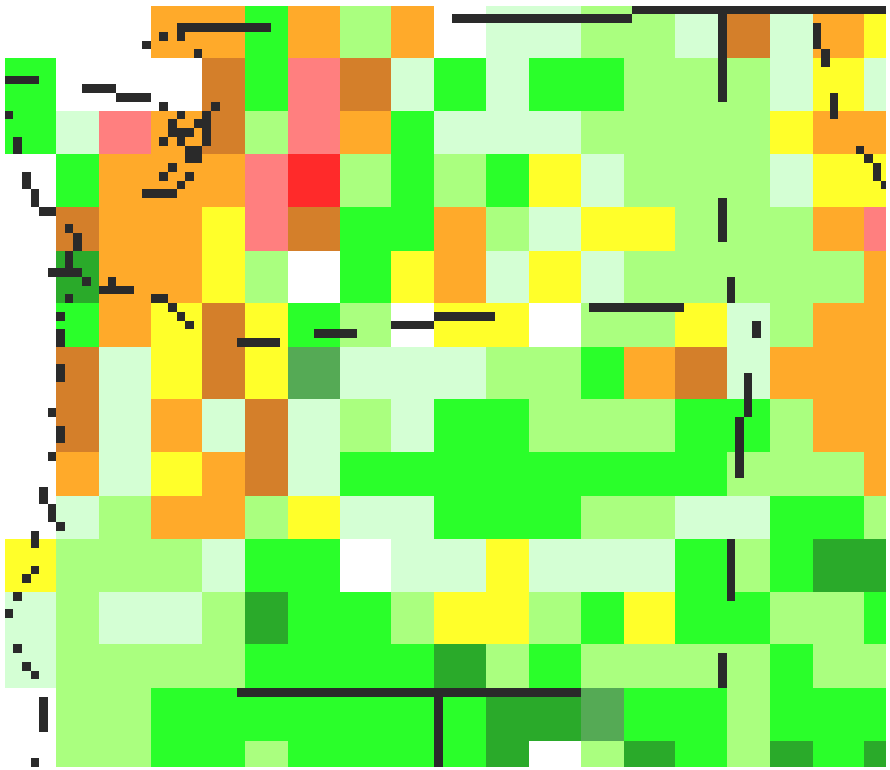
low summer streamflow; higher temp.

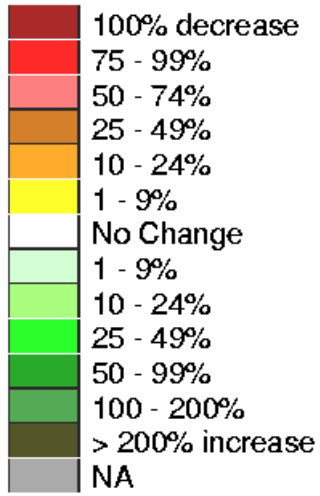
possible effects still unknown

changing estuary conditions (prey, predators, competitors)

Source: Mote 2005

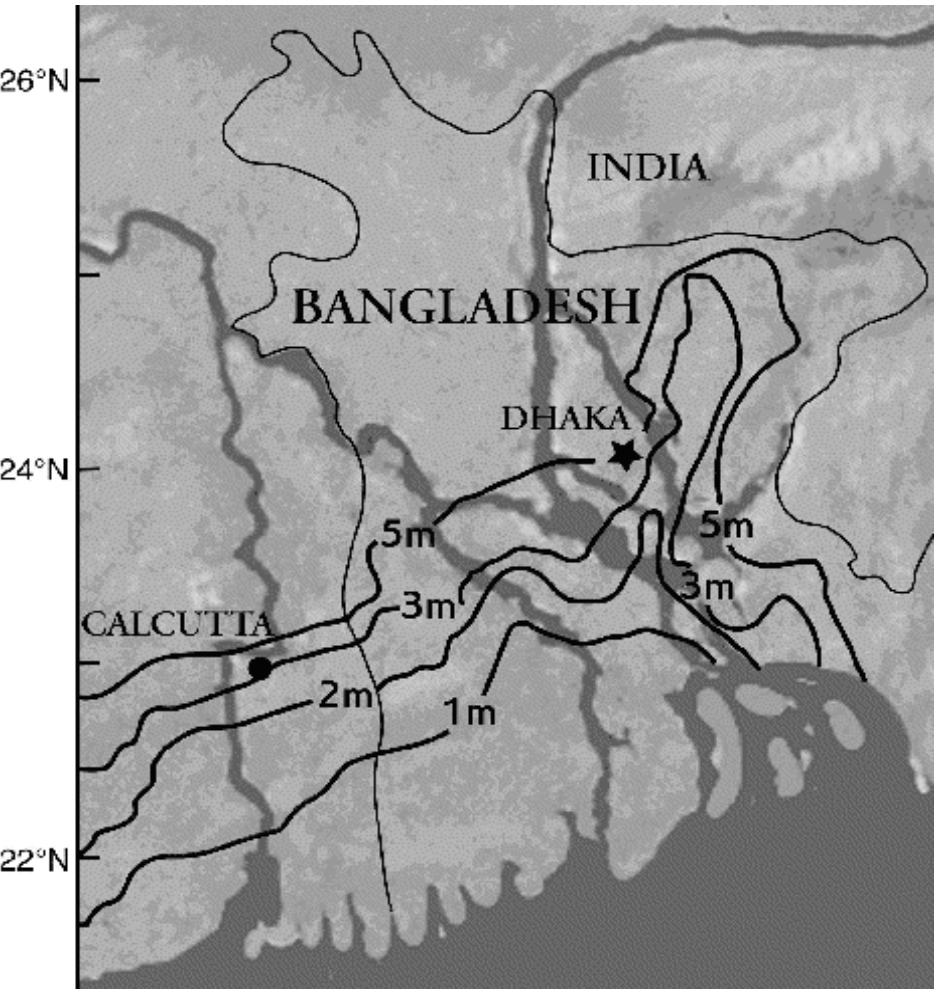
Vegetation carbon in 2070-2100





Source: Neilson 2005

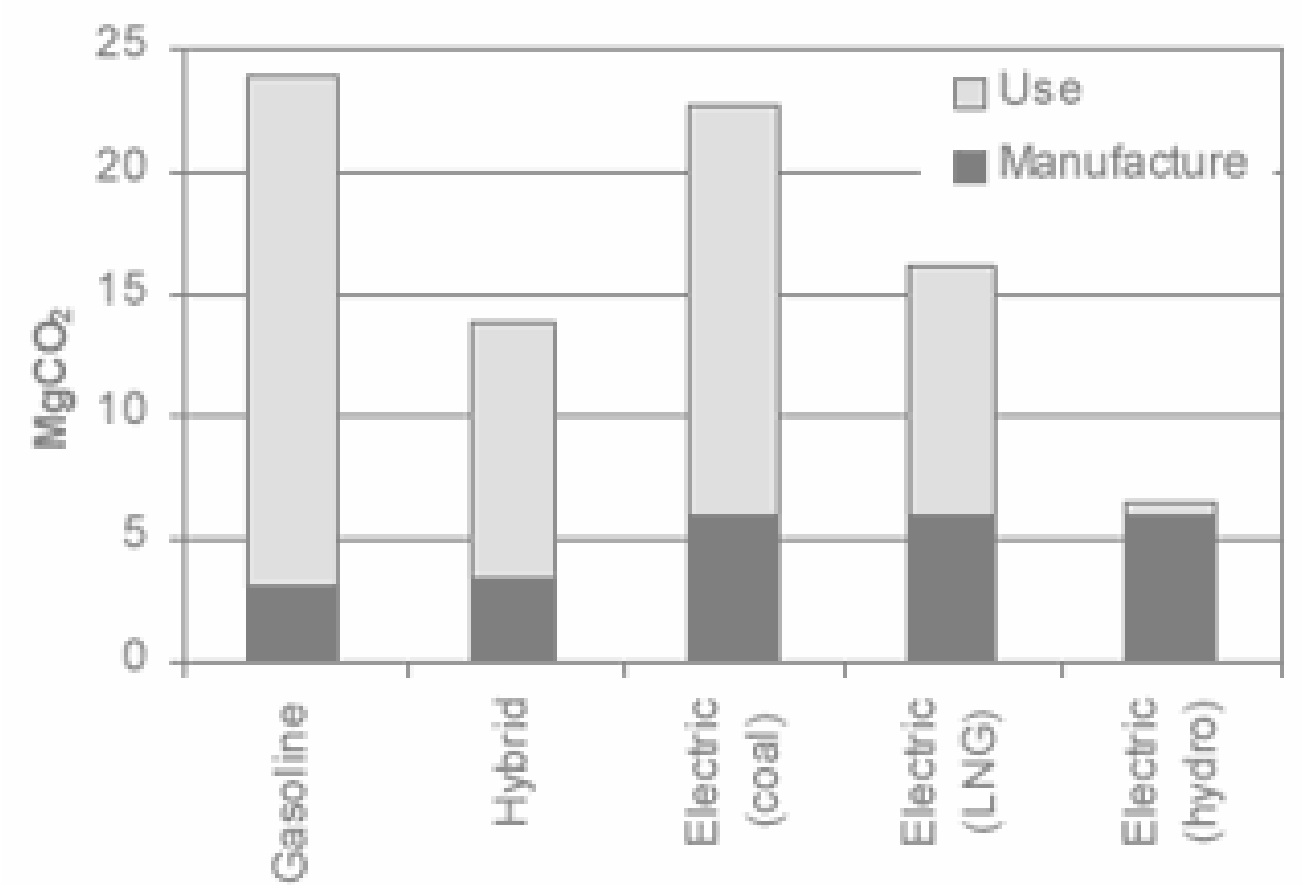
Sea Level Rise



1-5 meters in Bangladesh

7-8 meters in Florida

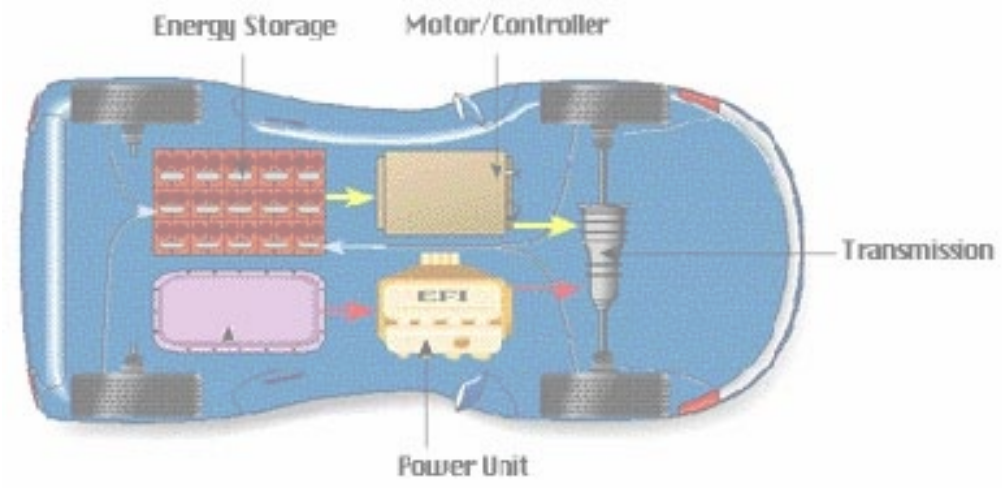
Gasoline, hybrid & electric car CO_2 emissions



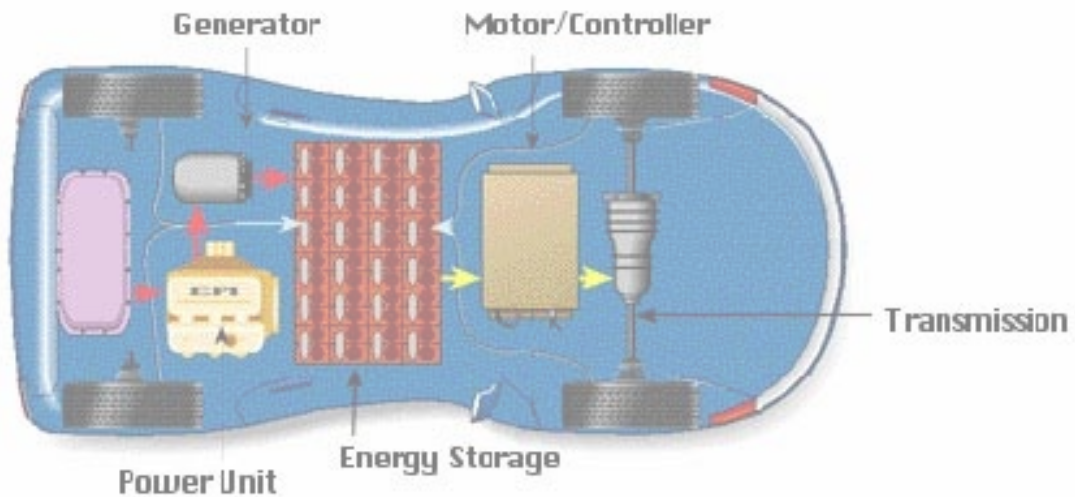
Source: Tahara et al 2001

Hybrid-electric vehicles

parallel design:

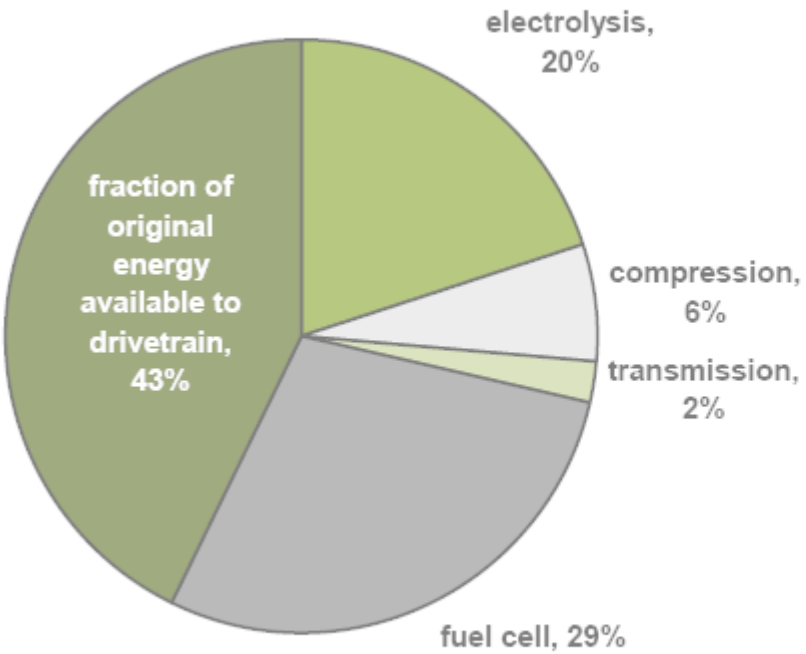


series design:

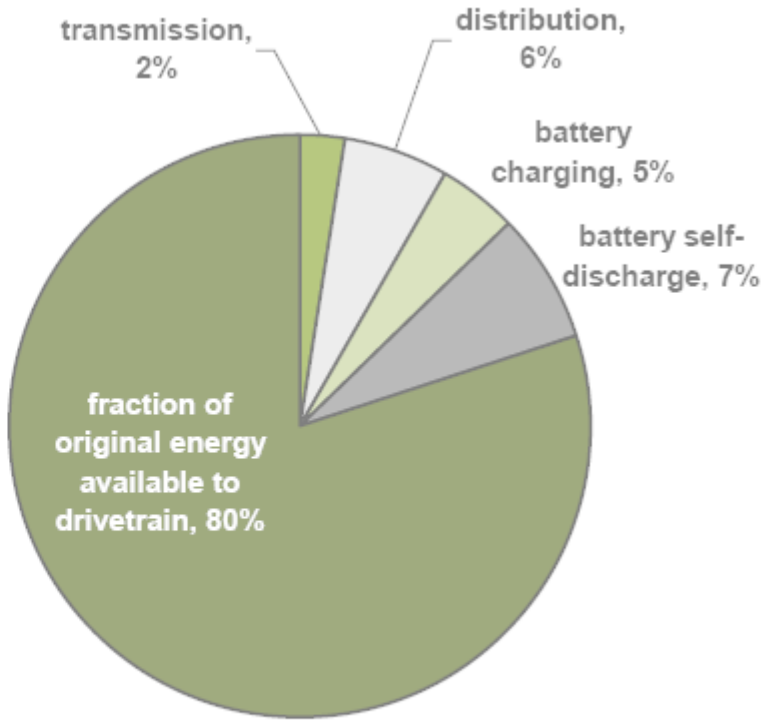


Source: U.S. DOE 2006

Hydrogen vs. electricity



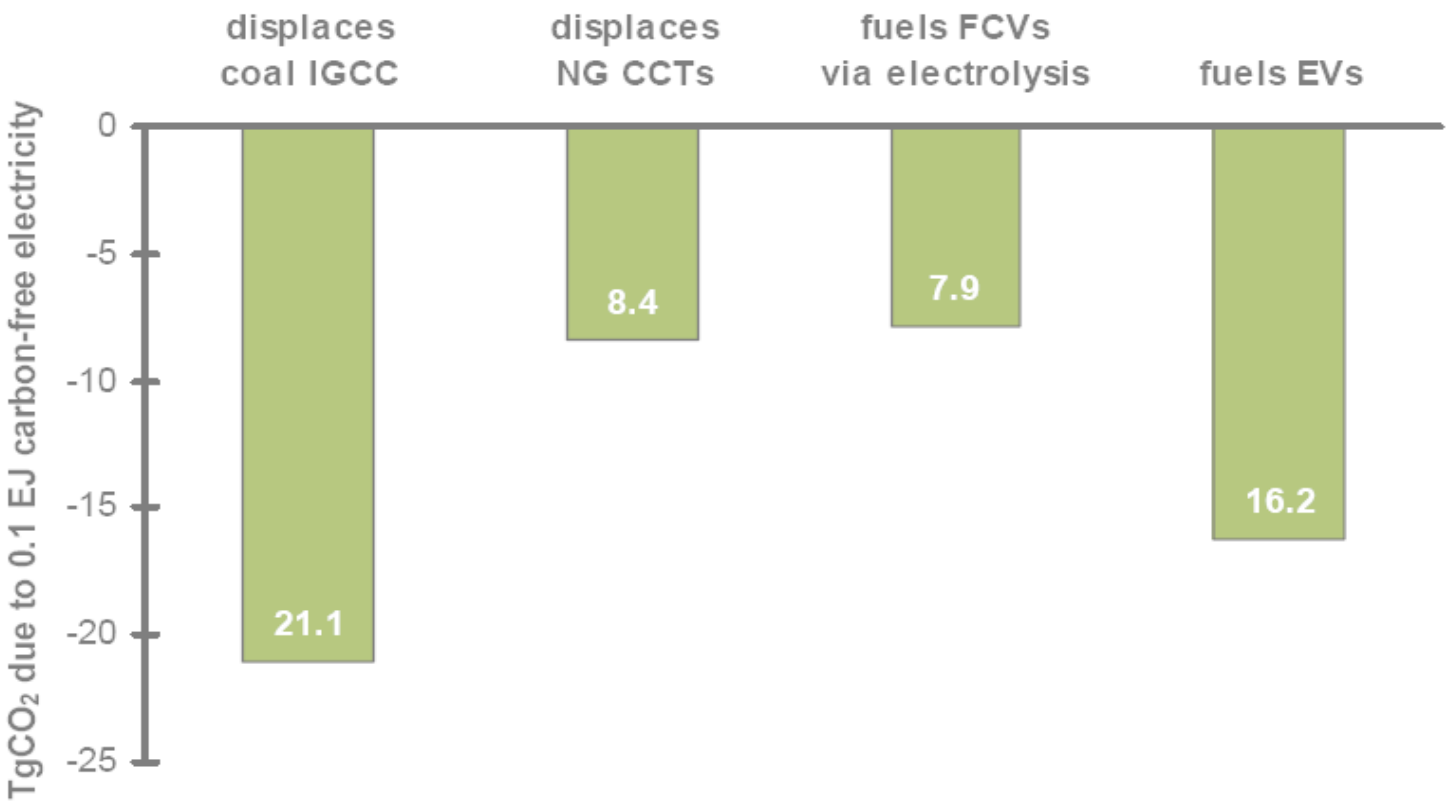
Energy losses in FCV fuel chain



Energy losses in EV fuel chain

Source: Mazza & Hammerschlag 2004

Competing uses of renewable energy



Source: Mazza & Hammerschlag 2004